

STAT

Page Denied

STAT

CHEMICAL CHARACTERISTICS OF SOVIET PETROLEUMS

[Comment and Summary: This report presents 15 tables showing the chemical composition of Soviet petroleum, extracted from the book Tekhnologiya Nefti (Petroleum Technology) by I. L. Guryevich, published in Moscow in 1952.

The tables contain data on the properties and characteristics of various petroleum products, as follows:

1. Composition of Natural Gas
2. Characteristics of Solid Hydrocarbons From Caucasian Petroleum
3. Detailed Chemical Composition of Benzines
4. Cyclene Content in Light Oil Fractions
5. Cyclene Content in Petroleum Fractions
6. Cyclene Content in Oil Fractions
7. Aromatic Hydrocarbon Content in Benzines up to 150 Degrees Centigrade of Various Petroleum
8. Naphthenic Acid Content in Petroleum
9. Naphthenic Acid Content in Petroleum Fractions
10. Basic Physicochemical Properties of Naphthenic Acids of Baku Petroleum
11. Gum Extraction From Petroleum by Adsorbents
12. Gum Distribution in Balakhan Petroleum Fractions
13. Density of Petroleum Fractions
14. Molecular Weights of the 25-Degree Spans of Oil Fractions
15. Molecular Heating Capacity of Hydrocarbons During Constant Pressure at Various Temperatures]

Table 1. Composition of Natural Gas

Deposit	Type Gas	Composition (%)						CO ₂	H ₂ S	N ₂
		Methane	Ethane	Propane	Butane	Isobutane	Pentane and Above			
Surakhan	Dry	96.73	1.84	.15	.10	.05	.33	.8	None	None
Ishimbay	Liquid	20.33	17.34	25.66	22.00	7.67	--	1.0	4.15	1.25

Table 2. Characteristics of Solid Hydrocarbons From Caucasian Petroleum

Deposit	Hydro-carbon	Melting point (deg C)	Density (100 deg C)	n ₁₀₀	Nitrobenzene point	Composition (%)		Molecular Wt	Empirical Formula
						C	H		
Groznyy	Paraffin	54.3	.752	.020	56	85.56	14.69	395	C _{28.1} H ₅₈
Surakhan	Ceresin	55.1	.786	.064	75	85.54	14.58	524	C ₃₇ H ₇₆
Bebe-Eybat	Ceresin	53.0	.8108	--	--	85.9	14.2	434	C _{29.9} H _{59.6}

STAT

STAT

Table 3. Detailed Chemical Composition of Benzines

Hydrocarbon	Hydrocarbon Content (% by wt)			
	Groznyy Benzine		Baku Benzine	
	Light (up to 150 deg)	Heavy (up to 200 deg)	Light (up to 150 deg)	Heavy (up to 200 deg)
Isopentane	2.1	1.5	0.5	0.3
n-Pentane	5.9	4.3	1.6	1.0
Cyclopentane	0.1	0.1	0.2	0.1
Isohexane	4.0	2.9	1.0	0.6
n-Hexane	7.6	5.4	3.0	1.8
Methylcyclopentane	2.4	1.7	2.6	1.5
Cyclohexane	3.3	2.2	7.0	4.2
Benzol	0.3	0.25	0.2	0.15
Isoheptane	4.4	3.2	6.1	3.6
n-Heptane	9.9	7.1	3.0	1.8
Cycloheptane	10.1	7.4	19.3	11.7
Methylbenzene	1.5	1.1	1.0	0.7
Iso-octane	9.0	6.4	9.6	5.8
Cyclo-octane	6.8	4.9	15.5	9.4
n-Octane	8.9	6.3	5.6	3.4
Xylol	3.2	2.3	2.1	1.3
Cyclononane	5.8	4.2	13.3	8.2
Isononane	8.6	6.1	5.4	3.2
n-Nonane	6.1	4.4	3.0	1.8

STAT

Table 4. Cyclene Content in Light Oil Fractions

<u>Petroleum</u>	<u>Boiling Temp of Fraction, (deg)</u>	<u>Cyclene Content (%)</u>	
		<u>6-member</u>	<u>5-member</u>
Balakhan, light	60- 95	33	29
	95-122	49	27
	122-150	40	32
Groznyy, paraffin	60- 95	11	26
	95-122	14	22
	122-150	8	22
Ishimbay	60- 95	5.6	12.9
	95-122	12.2	15.8
	122-150	17.8	14.1

Table 5. Cyclene Content in Petroleum Fractions

<u>Petroleum</u>	<u>Cyclene Content (% per fraction, by deg)</u>				
	<u>60-95</u>	<u>95-122</u>	<u>122-150</u>	<u>150-200</u>	<u>200-250</u>
Balakhan, light	56	68	66	75	74
Dossor	40	63	57	69	67
Groznyy, paraffin	34	37	30	29	23
Ishimbay	23	24	24.5	27.5	24.5

Table 6. Cyclene Content in Oil Fractions

<u>Petroleum</u>	<u>Cyclene Content (% per fraction, by deg)</u>					
	<u>250-300</u>	<u>300-350</u>	<u>350-400</u>	<u>400-450</u>	<u>450-500</u>	<u>500-550</u>
Balakhan, light	78	78	76	74	74	76
Dossor	78	--	83	83	80	82
Groznyy, paraffin	44	54	62	71	70	71
Ishimbay	26	30	30	40	33	30

STAT

Table 7. Aromatic Hydrocarbon Content in Benzines
Up to 150 Degrees Centigrade of Various Petroleum

	Benzine yield (%)	Content in crude (%)			Highest % Aromatics in	
		Benzol	Toulene	Xylene	Benzine	Petroleum
Lok-Batan, paraffin	42.4	.41	.56	.65	3.8	1.65
Bebe-Eybat, light	11.1	.08	.34	.83	11.2	1.25
Groznyy, non- paraffine	20.3	.17	.45	.61	6.0	1.23
Groznyy, paraffin	8.6	.01	.05	.22	3.2	.28
Maykop-Apsheron	27.3	.76	.91	1.60	12.6	3.43
Dossor	4.7	.02	.02	.12	3.4	.16
Ishimbay	8.8	.30	.31	.53	12.8	1.14
Chusovskiye Gorodki (Perm')	16.6	1.02	2.30	4.34	46.1	7.66
Shor-Su, Horizon K [Fergana oblast, Uzbek SSR]	14.9	.24	.54	1.00	11.9	1.78

Table 8. Naphthenic Acid Content in Petroleum

Petroleum	Naphthenic Acid Content (%)	Density, q 20 4
Balakhan, heavy	1.76	.919
Lok-Batan	1.50	.9018
Groznyy, non paraffin	1.00	.8625
Dossor	.80	.862
Maykop	.40	.8931
Surakhan, paraffin	.25	.8682
Groznyy, paraffin	.20	.8432
Shor-Su	.10	.8686

STAT

Table 9. Naphthenic Acid Content in Petroleum Fractions
(In Percent)

Fraction	Types of Crudes					
	Balakhan		Bebi-Eybat	Emba	Maykop	Groznyy
	Heavy	Lube				Paraffin Asphalt
Kerosene	.69	.83	.36	.29	.55	.01 1.08
Solar oil	2.48	1.65	1.48	1.36	1.05	.04 2.34
Gas oil	1.60	1.54	1.35	.80	1.50	-- --
Spindle oil	2.98	1.57	--	1.58	--	-- --
Vaseline	--	--	1.44	1.97	--	-- --
Machine	2.68	1.16	1.94	--	--	-- --
Cylinder	1.90	.82	1.17	--	--	-- --

Table 10. Basic Physicochemical Properties of Naphthenic Acids
of Baku Petroleums

Distillate From Which Naphthenic Acid is Obtained	Distillate Properties		Naphthenic Acid Properties			
	Density Q 20 4	Viscosity E ₃₀	Acid No mg KOH	Density Q 20 4	Viscosity E ₃₀	Iodine Number
Kerosene	.825	1.6	230.	.950	--	2.62
Gas oil	.864	1.45	186.5	.952	8.35	--
Solar oil, light	.882	2.10	170.	.951	15.0	2.42
Solar oil, heavy	.892	3.40	136.	.942	18.9	2.50
Spindle oil	.902	7.12	108.	.936	34.76	6.17
Machine	.910	16.12	87.5	.935	47.71	7.18
Cylinder	.921	--	32.6	.929	92.92	11.36

Table 11. Gum Extraction From Petroleum by Adsorbents

<u>Petroleum</u>	<u>Petroleum Density</u>	<u>Asphaltenes</u>	<u>Gum Extraction by</u>			
			<u>Silica Gel</u>		<u>Activated Clay</u>	
			<u>Percent</u>	<u>Gum Density</u>	<u>Percent</u>	<u>Gum Density</u>
Balakhn	.878	Traces	4.78	1.04	7.74	1.02
Groznyy, paraffin	.841	.91	4.80	1.06	7.86	1.06
Groznyy, nonparaffin	.853	1.83	7.75	1.05	12.70	1.04
Maykop (Kaluga)	.955	.94	14.85	1.05	33.65	1.14

- 7 -

STAT

Table 12. Gum Distribution in Balakhan Petroleum Fractions

Product	Distillate Content in Petroleum (%)	Density of Gum	Gum Consistency	Gum Composition (%)				Gum Concen- tration in Distillate (%)	Molecular Wt	
				C	H	S	N+ +O		Distillate	Gum
Balakhan petroleum	--	1.04	Solid	83.48	10.42	0.75	5.35	5.55	268	738
Benzene distillate	6	--	--	--	--	--	--	0	--	--
Kerosene distillate	32	1.01	Liquid	78.70	9.61	1.73	9.96	.195	164	265
Gas oil	4	1.02	Semi- Liquid	77.85	9.75	3.68	8.72	.35	217	317
Solar distillate	19	1.03	Semi- Liquid	79.68	9.71	2.56	8.05	1.19	277	361
Machine distillate	12	1.03	Semi- Liquid	81.54	9.64	1.00	7.82	4.13	367	433
Cylinder distillate	2	1.03	Solid	82.94	9.76	1.08	6.22	9.83	420	514
Petroleum asphalt	25	1.04	"	85.28	10.26	1.40	4.06	19.83	708	969

STAT

Table 13. Density of Petroleum Fractions

Petroleum	Boiling Range of Fractions (deg C)										
	60-95	95-122	122-150	150-200	200-250	250-300	300-350	350-400	400-450	450-500	500-550 Residue
Dossor Rho 20 = .862	.705	.747	.771	.799	.836	.858	.869	.881	.886	.891	.897
Surakhan, paraffin Rho 20 = .848	.743	.760	.779	.810	.829	.836	.843	.850	.867	.879	.890
Groznyy, paraffin Rho 20 = .844	.706	.737	.757	.782	.804	.830	.836	.846	.864	.878	.897
Balakhan Rho 20 = .876	.726	.762	.781	.805	.829	.848	.858	.881	.898	.911	.920
Groznyy, asphalt Rho 20 = .887	.708	.746	.767	.748	.842	.876	.880	.900	.915	.929	.943
Ishimbay Rho 20 = .868	.7017	.7328	.757	.7842	.8255	.861	.8832	.8832	.9043	.9111	.934
Tuymaza, devonian Rho 20 = .8517	.696	.7273	.7273	.7489	.8134	.8267	.8413	.8583	.8827	.8964	.9238

The asphaltene and gum content in the above petroleum is as follows: 2% in Dossor, 4% in Surakhan, 5.4% in Grozny paraffin, 7% in Balakhan, 12% in Grozny asphalt, 14.1% in Ishimbay, and 10% in Tuymaza.

STAT

Table 14. Molecular Weights of the 25-Degree Spans of Oil Fractions

Petroleums	Range of Temperature (deg C)										
	275-300	300-325	325-350	350-375	375-400	400-425	425-450	450-475	475-500	500-525	525-550
Groznyy, paraffin	218	229	245	265	284	305	328	352	378	406	436
Balakhan	198	210	228	248	271	294	321	351	379	410	442
Groznyy, asphalt	191	214	228	246	266	287	310	335	365	397	431
Binadag	205	217	231	248	269	291	315	342	372	402	436
Kirmakinskaya	201	214	237	243	265	288	315	341	369	401	434

- 10 -

STAT

Table 15. Molecular Heating Capacity of Hydrocarbons During Constant Pressure at Various Temperatures
M_{CP} (cal/molecule per deg C)

Hydrocarbons	Temperatures K°							
	300	400	500	600	700	800	900	1000
Methane	8.55	9.73	11.12	12.54	13.87	15.11	16.22	17.21
Ethane	13.05	16.14	19.20	21.92	24.30	26.38	28.21	29.82
Propane	17.42	22.15	26.70	30.67	34.09	37.05	39.63	41.87
Butane	21.86	28.24	34.27	39.49	43.95	47.79	51.10	53.98
Pentane	26.30	34.32	41.82	48.27	53.76	58.46	62.52	66.02
Hexane	30.78	40.43	49.41	57.10	63.62	69.20	73.99	78.13
Heptane	35.26	46.55	56.99	65.93	73.48	79.92	85.45	90.23
Octane	39.74	52.67	64.59	74.76	83.84	90.65	96.92	102.30
Ethene	10.48	13.69	14.89	16.87	18.51	19.86	21.45	22.62
Propene	15.43	19.11	22.68	25.83	28.55	30.92	32.97	34.75
1-butene	19.88	25.20	30.24	34.63	38.40	41.63	44.43	46.83
Pentene	24.35	31.31	37.83	43.46	48.24	52.35	55.72	58.92
1,3-butadiene	17.92	22.20	26.25	29.81	32.87	35.51	37.70	39.73
Isoprene	22.42	28.33	33.86	38.65	42.75	46.25	49.26	51.84
Acetylene	9.91	11.07	12.13	13.32	13.82	14.51	15.10	15.63
Benzene	19.91	26.37	32.21	37.10	41.16	44.54	47.37	49.75
Toluene	24.56	32.70	40.03	46.16	51.17	55.50	59.06	62.08
Ethyl benzene	29.06	38.84	47.64	55.01	62.11	68.24	73.54	78.18
Propyl benzene	33.55	44.97	55.25	63.85	70.99	76.97	82.01	86.28
Styrene	27.06	35.82	43.64	50.17	55.55	60.09	63.86	67.06
Cyclohexane	25.58	35.82	45.47	53.83	60.87	66.76	71.68	75.80
Methyl- cyclohexane	32.51	44.35	55.21	64.46	72.23	78.74	84.20	88.79
Ethyl- cyclohexane	38.20	51.60	63.80	74.10	82.80	90.10	96.20	101.30
								109.40

- E N D -
- 11 -

STAT